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Feeder Zone Control and Metal Impurity Detection in Blow Room Machines

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***Abstract*— this project has been designed to detect the metal impurities present in the raw cotton input for the blow room machines and to monitor the level of cotton in the feeder zone of the machine. This is done with the help of metal detectors and IR sensor respectively. Microcontroller is used to control the conveyor belt which supplies raw cotton to the feeder zone depending upon the data from metal detector and IR sensor. The microcontroller used here is ATmega32A.**

***Keywords*— Metal Detector, IR Sensor, Microcontroller, Blow Room, Feeder Zone**

I. INTRODUCTION

The blow room machines in the textile industries are responsible for producing cotton free from impurities like micro and macro dust particles which include sand, dust particles, twigs and leaves. This is done with the help of roller blades present inside the blow room machine. However, the presence of metal impurities, though rare, may damage the roller blades causing economic and production losses. Also, there occurs a loss of raw material when the cotton bales overflow from the feeder zone through the conveyor input. Hence, to overcome these problems we use metal detectors to detect metal impurities and IR sensors to maintain the level of cotton in the feeder zone.

II. PROPOSED DESIGN

This document gives the brief explanation of the block diagram, working of the individual units and their specifications of our proposed project design. The following block diagram shows the various units such as the power supply unit, microcontroller based control unit, metal detector unit, Infra – red sensing unit, relay driver, LCD display and indicating elements like buzzer and tower lamp.

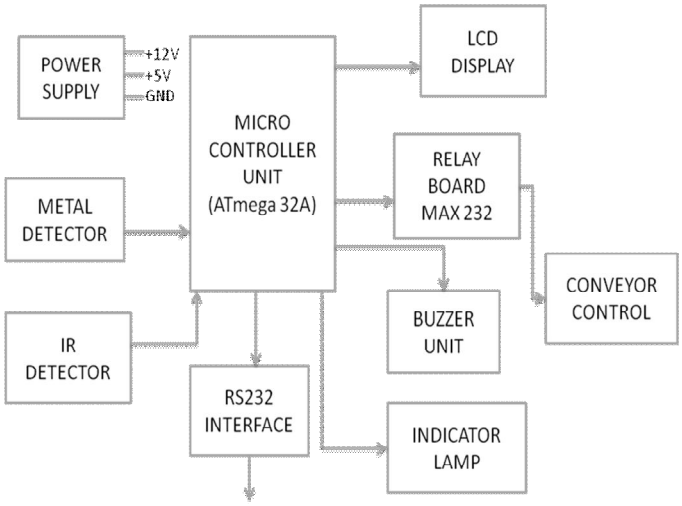


Fig 1 – Main Block Diagram

The above block diagram shows the individual units present in the project. The power supply unit provides the regulated DC supply for all the blocks of the unit. The microcontroller, LCD display and IR sensing units require +5V supply and the relay driver unit, buzzer and tower lamp require +12V supply. IR sensing unit is used to sense the level of cotton in the feeder zone and the metal detector is used to monitor the metal detection. Whenever a metal is detected or the cotton in the feeder tank exceeds the limit, the microcontroller stops the conveyor belt through a relay driver.

A. Power Supply Unit

Power supply is a device which supplies electrical or other types of energy to a load. The below block diagram shows the working

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of the power supply which we developed for our project.

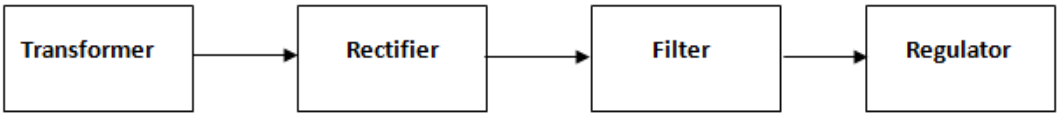


Fig 2 – Power Supply

The AC supply from the transformer is converted into a pulsating +12V signal through a rectifier and then given to a filter which converts it into a DC signal. This unit also uses two ICs, IC7812 for providing a regulated +12V supply and IC7805 for providing a regulated +5V supply.

B. Metal Detector Unit

A metal detector is placed above the conveyor belt few meters before where the cotton fall into the feeder tank. The metal detector works on the principle of Electro Motive Force (EMF) of a coil. An emf is induced when current flows through a coil. When another conductor is brought near the coil, some portion of the emf produced in the coil transfers to the conductor by the phenomenon of inductance. This causes a flux in the coil emf, thus indicating the presence of a metal in the vicinity. This flux operates a transistor, which acts as a switch, thereby giving an active low signal to the microcontroller whenever a metal is detected. The following diagram shows a simple metal detector circuit.

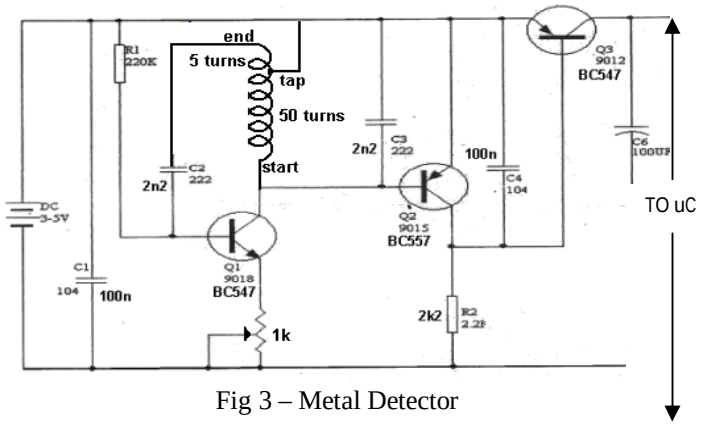


Fig 3 – Metal Detector

C. IR Sensor

An IR sensor placed at the feeder tank's threshold level is sends an active low signal to the microcontroller when the level of cotton in the feeder zone reaches the threshold level. The IR sensor consists of two parts – a transmitter made of a light emitting diode which continuously emits IR light and a receiver made of a photo detector which continuously receives the IR light emitted by the LED, making it a closed circuit. When the cotton lumps interrupt the path of the IR rays, the transistor connected to this transmits an active low signal to the microcontroller.

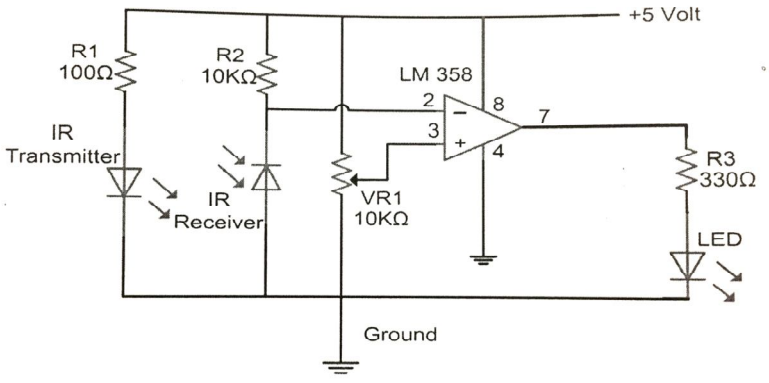


Fig 4 – IR Sensor

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D. Microcontroller Unit

The microcontroller used for our project is ATmega32A due to its various features like 10, 000 flashes/cycle, 100 years of data retention at 25ºC and advanced RISC architecture. ATmega32A uses a +5V supply for power. There are 32 programmable I/O lines in ATmega32A.

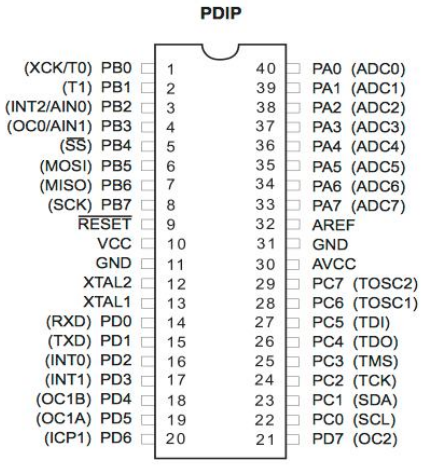


Fig 5 – Atmega32A Architecture

The microcontroller is the processing unit which controls the conveyor operation by controlling the relay drive and indicates the user using various methods like buzzer, LCD board and tower lamp. The microcontroller also sends information to the PC using an RS232 interface, through which various parameters like the time of metal detection, the time when the conveyor belt starts running again, the time when the cotton in the feeder zone was up to the threshold level and the current status of the conveyor belt can be monitored continuously. Based on the time period of each tasks, the workers performance can also be analysed. The metal detector and the IR sensor are connected to Port B of the microcontroller, LCD to Port A, relay and TRIAC to Port C and the RS232 interface to Port D.

E. Output Units

The output units consist of relay drive, TRIAC unit connecting with the tower lamp, buzzer, LCD and RS232 interface which connects with the PC that monitors the entire processing of the blow room machine.

The relay drive is connected to the gear motor of the conveyor belt and the rollers. The microcontroller sends the control signals to the relay drive depending on the inputs from the metal detector and the IR sensor. When an active low signal from the microcontroller comes to the relay drive, the Normally Close relay goes in to the Normally Open state. Then the relay switches off the conveyor belt and after the metal has been removed or the yarn in the feeder zone goes below the threshold level, the microcontroller sends a high signal and the relay goes back to Normally Close state and the conveyor starts running again.

To indicate the workers that the conveyor belt has stopped, a tower lamp and a buzzer are used. The glowing of a green colour lamp indicates that they conveyor is running without any problem, a red lamp glows when the conveyor stops due to metal impurity detection and a yellow lamp glows when the conveyor stops due to yarn overflow in the feeder zone.

III. CONCLUSIONS

This project serves two main purposes: (i) helps in metal impurity detection and (ii) helps in overflow control of the feeder zone. This is widely used in blow room machines of the textile industries and prevents the people from suffering economic and production losses. This project is also simple without much complexity which makes it efficient and easily constructible, thereby providing an easier solution to those two problems.

IV. ACKNOWLEDGMENT

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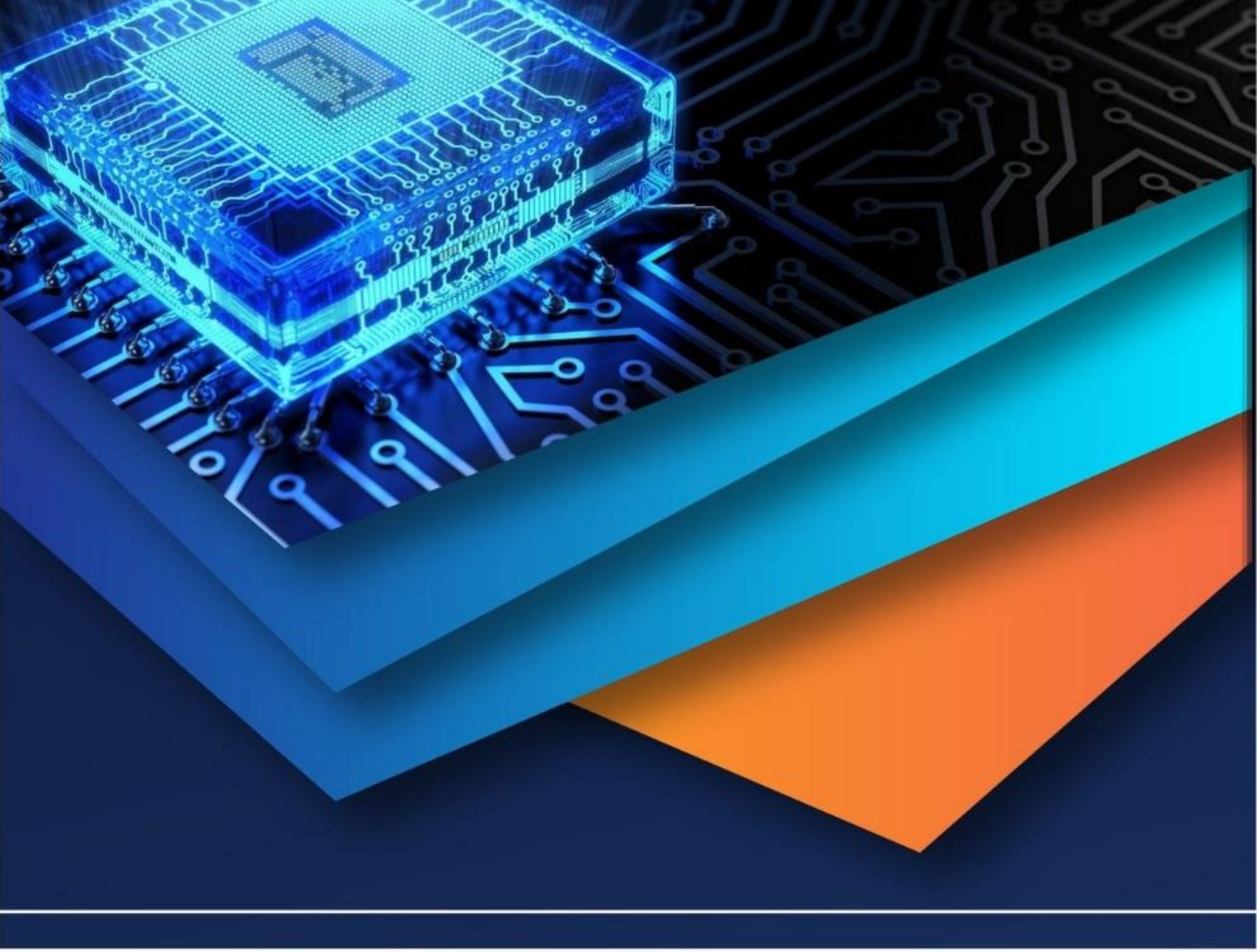
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